

NISTTech

Anti-HER2 IgY antibody-functionalized single-walled carbon nanotubes for detection and selective destruction of breast cancer cells

Combining antibodies and nanotubes as a potential diagnostic and therapeutic tool for breast cancer

Description

HER2 is one of a family of genes that help regulate the growth and proliferation of human cells. Normal cells have two copies of HER2, but about 20 to 25 percent of breast cancer cells have multiple copies of the gene, resulting in the overproduction of a HER2-encoded protein that is associated with a fast growing and difficult to treat tumors. About 40,000 women in the United States are diagnosed annually with this form of breast cancer.

Single-walled carbon nanotubes (SWNT) are cylinders of carbon about a nanometer in diameter and have potential applications such as ultrastrong fibers, electrical wires in molecular devices, or hydrogen storage components for fuel cells.

A NIST-led research team has developed a method for bonding anti-Her2 IgY, an antibody that has been created to attack HER2 chicken immunoglobulin Y (IgY) protein, to SWNTs. Both halves of the complex, the antibody (anti-Her2 IgY) and the nanotube, have critical roles to play in selectively detecting the HER2 cancer cells and eliminating them.

First, the anti-Her2 IgY antibody reacts strongly with the target protein expressed on tumor cells while ignoring normal cells with other human proteins. The carbon nanotubes attached to the antibodies also become linked to the HER2 tumors.

Two unique optical properties of carbon nanotubes allow this link to be exploited for improved detection and destruction of HER2 breast cancer cells. Near-infrared laser light at a wavelength of 785 nanometers reflects intensely off the nanotubes, and this strong signal is easily detected by a technique called Raman spectroscopy. Increase the laser light's wavelength to 808, nanometers and it will be absorbed by the nanotubes, incinerating them and anything to which they're attached, in this case, the HER2 tumor cells.

Abstract

Single-walled nanotubes--cylinders of carbon about a nanometer in diameter--have been highly touted for potential applications such as ultrastrong fibers, electrical wires in molecular devices, or hydrogen storage components for fuel cells. Thanks to a new development by researchers at the National Institute of Standards and Technology (NIST) and five partners, you can add one more application to the list: detection and destruction of an aggressive form of breast cancer.

Citations

1. Y. Xiao, X. Gao, O. Taratula, S. Treado, A. Urbas, R.D. Holbrook, R.E. Cavicchi, C.T. Avedisian, S. Mitra, R. Savla, P.D. Wagner, S. Srivastava and H. He. Anti-*HER2* IgY antibody-functionalized single-walled carbon nanotubes for detection and selective destruction of breast cancer cells. *BMC Cancer*, Vol. 9, No. 351, published online Oct. 2, 2009.

Related Items

- Article: Combining Nanotubes and Antibodies for Breast Cancer 'Search and Destroy' Missions
- Abstract:

Status of Availability

This technology is available in the public domain.

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